

## REMARKS

Claim 1 is the sole claim pending in the present application and has been amended to distinguish over the prior art of record. No new matter was added. Accordingly, Applicant respectfully submits that the present application is in condition for allowance.

### **I. Claim Objections**

*In the non-final Office Action dated October 2, 2008, claim 1 is objected to because of a formality, namely a typographical error in which the element "Sc" appears as "SC".*

Claim 1 has been amended to correct the recitation of "SC" to "Sc". No new matter was added. Applicant respectfully requests reconsideration and removal of the objection.

In addition, claim 1 has been amended to require the component "B" in the chemical formula  $Ra_{1-x}A_xBO_{3-\alpha}$  to be Mn. No new matter was added; for example, see Examples 1-11 disclosed in the present application, as filed.

### **II. Claim Rejections - 35 USC §103(a)**

*In the non-final Office Action dated October 2, 2008, claim 1 is rejected under 35 USC §103(a) as being obvious over the 1992 publication of Bates et al. titled "Synthesis, air sintering and properties of lanthanum and yttrium chromites and manganites" in view of JP 09-316630.*

#### **Background Information**

Foremost, before comparing claim 1, as amended, of the present invention and the cited references, an explanation is provided with respect to the present invention relative to conventional technology.

At the time of the present invention, a sputtering target of the claimed composition and high density for depositing a thin film via sputtering did not exist. (See page 1, lines 26-28, of

the present application, as filed.) Further, when this kind of perovskite oxide ceramic material was used as a sputtering target, its density and strength were insufficiently low and there were problems with fractures and cracks occurring during target manufacture, transfer of the target, and sputtering operations. (See page 2, lines 1-5, of the present application, as filed.) Still further, such a low density target provides another problem in that the unwanted generation of particles increase during the deposition process thereby deteriorating the quality of the thin films produced and increasing the amount of defective products produced. (See page 2, lines 1-5, of the present application, as filed.)

As best stated on page 2, lines 8-10, of the present application, as filed: “Therefore the improvement of density in this kind of ceramic material target existed as an *extremely formidable challenge*.”

Based on the inventor’s significant inventive contribution, the present invention provides a sputtering target that inhibits the occurrence of fractures and cracks and inhibits the generation of particles during sputtering. Thus, the present invention greatly improves yield with respect to manufacture and use of the target and greatly improves the quality of the film deposited via sputtering and reduces the generation of defective products.

As amended, claim 1 of the present application requires a sputtering target of a composition  $Ra_{1-x}A_x\text{MnO}_{3-a}$  in which “Ra” represents a rare earth element consisting of Y, Sc and lanthanoid, “A” represents Ca, Mg, Ba or Sr, and  $0 < x \leq 0.5$ . In addition, the sputtering target is required to have a relative density of 95% or more, an average crystal grain size of  $100\mu\text{m}$  or less, a resistivity of  $10\Omega\text{cm}$  or less, and a purity of 3N or more.

The cited prior art neither discloses nor renders obvious the inventor's contribution as recited in claim 1 of the present application. At the time of the invention, one of ordinary skill in the art is simply not enabled by the cited references to produce a sputtering target required by claim 1. Accordingly, Applicant respectfully submits that the art of sputtering targets for use in sputtering thin films has been advanced, that the invention is meritorious, and that claim 1 is worthy of allowance.

Bates et al.

For the following reasons, Applicant respectfully submits that Bates et al. fail to disclose and/or render obvious the subject matter required of claim 1, as amended.

In the Office Action, it is readily acknowledged that Bates et al. fail to teach a sputtering target comprised of the claimed composition and a sputtering target of the claimed composition having a purity of 3N or more. However, based on the amendment made to claim 1, Applicant respectfully submits and requests reconsideration that Bates et al. also fails to disclose the limitations with respect to crystal grain size, relative density, and resistivity. Thus, while Bates et al. may vaguely disclose a composition, it fails to provide one of ordinary skill in the art with sufficient information regarding the sputtering target required of claim 1, as amended, of the present application.

(i) Crystal Grain Size

In the Office Action, the claim limitation requiring the *sputtering target* to have an average crystal grain size of 100 $\mu$ m or less is stated as being disclosed on line 3 of the Abstract of the Bates et al. publication. However, lines 2-3 of the Abstract of the Bates et al. publication clearly states that: "The *resulting powders* ... vary in size between 1 and 100nm". In contrast,

the present application requires the sintered body sputtering target to have the required grain size, not the raw material powder.

Accordingly, Applicant respectfully submits that Bates et al. clearly fail to disclose or render obvious a sintered compact body or sintered body sputtering target that has the required average crystal grain size. The size of the raw material powder provides no indication or disclosure of the average crystal grain size of a sintered compact body. Applicant respectfully requests reconsideration of the Bates et al. reference and the rejection of claim 1 for this reason.

(ii) Relative Density

In the Office Action, the claim limitation in the present application requiring the sputtering target to have a relative density of 95% or more is stated as being disclosed on “page 237, under section 3 Air-sintering of *chromites*, first paragraph, line 8-9; first paragraph under section 3.2 and Fig. 2; First line, page 239” of the Bates et al. publication. However, all these statements of Bates et al. are made with respect to  $Y_{1-x}Ca_xCrO_3$  or  $La_{1-x}Ca_xCrO_3$ . For example, Section 3 of Bates et al. is titled “Air-Sintering of *Chromites*” and the disclosure provided by the entire section is limited to *chromites*. Further, in the Abstract of Bates et al., high density is referenced, but only in connection with “*chromite* powders”.

The composition of the sputtering target of claim 1, as amended, of the present application is required to be  $Ra_{1-x}A_xMnO_{3-\alpha}$ . It is not a chromite.

Accordingly, Applicant respectfully submits that Bates et al. clearly fail to disclose or render obvious a sintered body sputtering target made of  $Ra_{1-x}A_xMnO_{3-\alpha}$  having the required relative density. Applicant respectfully requests reconsideration of the Bates et al. reference and the rejection of claim 1 for this reason.

### (iii) Resistivity

In the Office Action, the claim limitation in the present application requiring the sputtering target to have a resistivity of  $10\Omega\text{cm}$  or less is stated as being disclosed by converting the electrical conductivity of FIG. 6 of the Bates et al. publication.

FIG. 6 of Bates et al. is limited in disclosing electrical conductivity of  $\text{Y}_{1-x}\text{Ca}_x\text{CrO}_3$ . In the case of Cr, Bates et al. teach that it is possible to obtain high conductivity since the ion radius of the bivalent positive ions coincide with the ion radius of the respective constituent elements. However, this clearly would not apply to the composition having Mn required of claim 1, as amended, of the present application. It would be clear to one of ordinary skill in the art that a perovskite oxide containing Mn will not have an electrical conductivity that is equivalent to a perovskite containing Cr.

Further, Bates et al. disclose that the electrical properties of Mn will change considerably based on the sintering conditions and the like. See page 240, Section 4, of the Bates et al. publication. Bates et al. teach sintering in air at  $1550^\circ\text{C}$ . In contrast, the present application requires the sputtering target to be sintered under an inert gas atmosphere, such as Ar gas, at 800 to  $1500^\circ\text{C}$ . See page 3, line 27, of the present application, as filed.

As stated above, the composition of the sputtering target of claim 1, as amended, of the present application is required to be  $\text{Ra}_{1-x}\text{A}_x\text{MnO}_{3-\alpha}$ . It is not a chromite. In addition, the sintering conditions required in the present application are different than those taught by the Bates et al. publication. Bates et al. acknowledges that electrical properties will change considerably based on sintering conditions and the like.

Accordingly, Applicant respectfully submits that Bates et al. clearly fail to disclose and/or render obvious a sintered body sputtering target made of  $\text{Ra}_{1-x}\text{A}_x\text{MnO}_{3-\alpha}$  having the

required resistivity. Applicant respectfully requests reconsideration of the Bates et al. reference and the rejection of claim 1 for this reason.

Accordingly, it is clear that Bates et al. fail to disclose a sintered compact body *sputtering target* formed of  $Ra_{1-x}A_x\text{MnO}_{3-\alpha}$  and having all claimed requirements concerning crystal grain size, relative density, resistivity, and purity. Thus, one of ordinary skill in the art is clearly not taught the invention required by claim 1, as amended, of the present application by Bates et al. nor is the invention obviated by the Bates et al. publication. Bates et al. fail to fairly disclose every limitation required by claim 1 and there is no common sense reasoning for modifying any aspect of the composition of Bates et al. to produce a sputtering target.

#### JP '630

JP '630 discloses a sintered compact sputtering target expressed with the general formula  $Ba_{1-x}Sr_x\text{TiO}_{3-y}$  with an oxygen deficiency. One of ordinary skill in the art recognizes that such a perovskite oxide is a type 2-4 perovskite oxide formed from bivalent Ba and Sr and quadrivalent Ti.

In contrast, the perovskite oxide of  $Ra_{1-x}A_x\text{MnO}_{3-\alpha}$  required by claim 1, as amended, of the present application has a so-called laminated perovskite of type 3-3.

Accordingly, Applicant respectfully submits that one of ordinary skill in the art would avoid combining the teachings of the perovskite oxide of JP '630 with that of Bates et al. based on the different perovskite structure and the different components of the oxide. Any combination would certainly not be obvious. Further, the deficiencies of Bates et al. concerning average crystal grain size, relative density, and resistivity of a sputtering target formed of perovskite oxide of  $Ra_{1-x}A_x\text{MnO}_{3-\alpha}$  are certainly not disclosed or obviated by JP '630.

Thus, one of ordinary skill in the art is provided with no common sense reason or teaching from the references for providing a sputtering target specifically requiring the target to be formed of  $Ra_{1-x}A_x\text{MnO}_{3-\alpha}$  in which “Ra” represents a rare earth element consisting of Y, Sc and lanthanoid, “A” represents Ca, Mg, Ba or Sr, and  $0 < x \leq 0.5$ , and in which the sputtering target has a relative density of 95% or more, an average crystal grain size of  $100\mu\text{m}$  or less, a resistivity of  $10\Omega\text{cm}$  or less, and a purity of 3N or more.

For these reasons, Applicant respectfully requests reconsideration of the references and rejection and submits that claim 1, as amended, is patentable over Bates et al. in view of JP ‘630. Accordingly, Applicant respectfully requests removal of the rejection.

### **III. Conclusion**

In view of the above arguments and remarks, Applicant respectfully submits that the objections and rejections have been overcome and that the present application is in condition for allowance. Thus, a favorable action on the merits is therefore requested.

Please charge any deficiency or credit any overpayment for entering this Amendment to our deposit account no. 08-3040.

Respectfully submitted,  
Howson & Howson LLP  
Attorneys for Applicants

By           /William Bak/            
William Bak  
Reg. No. 37,277  
501 Office Center Drive  
Suite 210  
Fort Washington, PA 19034  
(215) 540-9216